HIGH LIGHTS OF AIR TRAVEL.

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First of all, upon ascending, the passenger is impressed with the map-like appearance of the landscape. Country roads, sandy beaches, and other barren lands appear conspicuously bright, while the country itself is surprisingly dark, because of the large amount of shadow. The accompanying table of approximate reflection factors illustrates the general low reflection factors of the various earth and water areas:

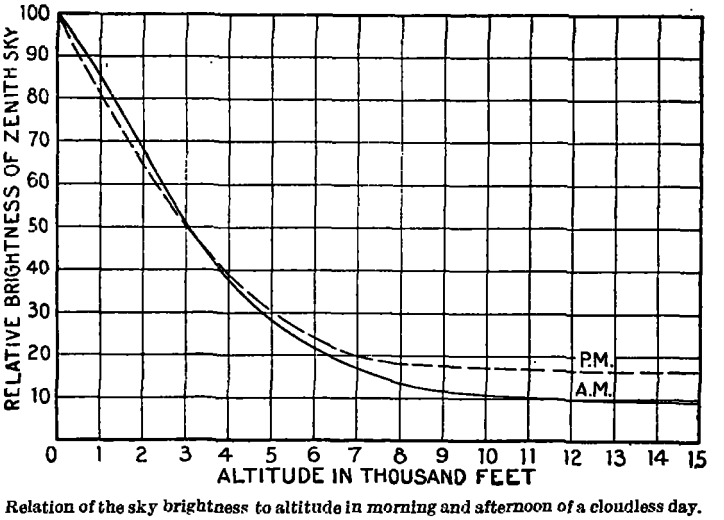
	Per cent.
Woods	3 to 5
Fields of grass and low-growing crops	5 to 10
Barren land (depending upon soil)	5 to 20
Inland water	5 to 10
Deep ocean water	3 to 5
Upper sunlit surface of dense clouds	70 to 80
Fresh deep snow	70 to 80
Compare:	
Perfectly white surface	100
Best white pigments	80 to 90
Black pigments	1 to 4
Black velvet	0.4

"Wet soil is darker than dry soil, owing to the moisture which fills the interstices. The refractive index of water is greater than that of air, with the result that there is less light reflected at the surface of the particle of soil bounded by water than when air replaces the water. The brightness of barren land obviously varies greatly with the kind of soil, but even for the same soil there is a considerable variation, depending upon the character of the surface. A freshly plowed field, even after it has dried, is much darker than after it has become smoothed by many rains. This is another example of the effect of shadows and light traps."

"Water varies in brightness and color, depending upon its depth and clarity. Very muddy streams in flood are exceptional cases and have the color and brightness of the soil. Ordinary inland waters, such as rivers, large lakes, and bays, are usually a dirty yellowish green in color, with a mean reflection factor of 7 per cent. Deep ocean water is a dark greenish blue and possesses a reflection factor of about 3 or 4 per cent. The brightness of water may be divided into two parts. One is due to the reflection of images of the sky and clouds, and this component of brightness obviously depends upon the *brightness* of the objects themselves and upon the angle of incidence of the light. The other component is due to light diffused within the water due to suspended matter and bubbles, and it depends upon the *intensity of illumination*."

Cloud shadows are very conspicuous when seen from above, and quiet pools of water appear with almost inky blackness; in fact, they are often the darkest spots of the landscape. "This is easily explained. The water is perfectly clear and the bottom is black and porous. Little or no light is reflected except from the surface. Viewing a clear sky at perpendicular incidence, the brightness of the reflected image is only 2 per cent of the brightness of the sky. The sky contributes only a small part of the total light on a clear day and hence this 2 per cent of the brightness of the sky corresponds to but a fraction of 1 per cent of the brightness of a white surface receiving light from both the sun and sky. This accounts for the visibility of submerged objects, such as fish, mines, and submarines, and even the bottom itself if the water is not too deep, when these are viewed vertically downward ro nearly so."

The haze limit, which varies from 4,000 to 10,000 feet, is also one of the most beautiful effects of cloudland. The line is usually very sharply defined, and above it the sky possesses a purity of color such as is seldom seen from the earth's surface. Moreover, the heads of great cumuli reared through the haze like icebergs afford one of the remarkable sights in the air. "Clouds appear yellowish by contrast with this bluish or purplish haze and clouds floating in this tinted luminous ocean provide one of the beautiful effects of the aerial world. Sometimes there is an upper haze, apparently of [attenuated] clouds, but so thinly diffused and uniform that no cloud shapes are visible. Both of these hazes are chiefly responsible for the brightness of the sky, although the earth haze contributes the predominant portion of the sky brightness as seen from the earth's surface. If there were no particles in the atmosphere to be illuminated, that is, to diffuse light, the sky would be black or nearly so in the day time and stars would be visible. * * * At 20,000 feet the sky is sometimes very dark and measurements have shown that it contributes at this altitude as little as 4 per cent of the toal illumination on a horizontal surface at midday. The variation of sky brightness is illustrated by the two curves plotted from data obtained in the morning and in the afternoon on the same day. The points where the curves flatten indicate the top of the haze."



Relation of the sky brightness to altitude in morning and afternoon of a cloudless day.

"Of course, the haze reduces visibility, but it does not add much to the earth's brightness as seen from above because it reduces the earth's brightness by absorption as well as increasing it by reflection. From the standpoint of visibility the haze is generally more annoying to the observer at altitudes of about a mile than at very high altitudes because at the lower altitudes the observer in attempting to penetrate distance looks through a greater length of haze than is the case at high altitudes." The brightness of the upper surface of clouds is dependent upon their density or depth. When deep or dense they reflect light like great banks of snow or white pigments. The range of vision at high altitudes is also of interest. At a height of 4 miles on a clear cloudless day this range amounts to approximately 200 miles. "The extent of the range of vision is especially emphasized in viewing one of Nature's most wonderful spectacles—a storm—as only a single scene in a tremendous panorama."—*C. L. M.*